(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 December 2002 (12.12.2002)

PCT

(10) International Publication Number
WO 02/099520 A1

(51) International Patent Classification[7]: G02F 1/133

(21) International Application Number: PCT/KR02/01053

(22) International Filing Date: 4 June 2002 (04.06.2002)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
2001/31067 4 June 2001 (04.06.2001) KR

(71) Applicant *(for all designated States except US)*: **NITGEN CO., LTD.** [KR/KR]; 18th Fl. Korea Sanhak Research, Foundation Bldg, 1337-31 Seocho-Dong, Seocho-Gu, Seoul 137-070 (KR).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **MIN, Kyoung-Il** [KR/KR]; 191-27 Jeungsan-Dong, Eunpyeong-Gu, Seoul 122-100 (KR). **RYU, Han-Min** [KR/KR]; 74-192 Jangwi2-Dong, Sungbuk-Gu, Seoul 136-830 (KR). **LEE, Kyoung-Tai** [KR/KR]; 204-67 Sangdo2-Dong, Dongjak-Gu, Seoul 156-838 (KR). **LEE, Dong-Won** [KR/KR]; 112-402 Hyundae Apartment, 700-1(1/18) Poongdukchun-Ri, Suji-Eup, Yongin, Gyunggi 449-846 (KR).

(74) Agent: **PARK, Sungmin**; 3F. Dongbo Bldg, 647-8, Yoksam-dong, Gangnam-Gu, Seoul 135-080 (KR).

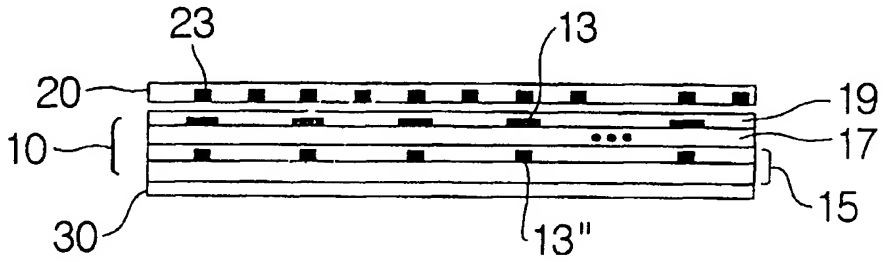
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: LCD PANEL HAVING IMAGE ACQUISITION FUNCTION



(57) Abstract: Disclosed is an LCD panel also functioning as image acquisition. This invention includes a plurality of LCD panels overlapped with a plurality of image acquisition panels such as fingerprint acquisition panels so that opaque sections of a unit cell in the LCD panel can be maximally overlapped with opaque sections of a unit cell in the image acquisition panel, while an absolute area of the opaque sections of the respective unit cells can be minimized, thereby optimally maintaining the quality of image acquired through the image acquisition panel as well as the quality of image outputted through the LCD panel. The LDC panel also functioning as image acquisition according to the invention has advantageous effects of reducing the electric power consumption, elongating the life span of the product, and achieving a high quality LCD image output as well as a high quality image acquisition through maximization of the light penetration by manufacturing the size of each unit cell of the image acquisition panel to be one time, two times, three times, etc. of each unit cell of the LCD panel so as to position the LCD panel and the image panel on a cell level.

WO 02/099520 A1

LCD PANEL HAVING IMAGE ACQUISITION FUNCTION

Technical Field

The present invention relates to a liquid crystal display (LCD) panel also functioning as image acquisition, and in particular, to a panel simultaneously performing LCD and image acquisition according to its construction, under which an LCD panel is overlapped with an image acquisition panel such as a fingerprint acquisition panel so that opaque sections of a unit cell in the LCD panel can be maximally overlapped with opaque sections of a unit cell in the image acquisition panel, while an absolute area of the opaque sections of the respective unit cells can be minimized, thereby optimally maintaining the quality of image acquired through the image acquisition panel as well as the quality of image outputted through the LCD panel.

Background Art

Conventionally, an LCD panel also functioning as image acquisition comprises a plurality of LCD panels layered between a plurality of image acquisition panels, each panel being partitioned into transparent sections and opaque sections so as to simultaneously perform image display and image acquisition when light is irradiated thereto from a single light source.

The LCD panel comprises a plurality of unit cells, each unit cell being partitioned in horizontal and vertical directions for controlling amount of light penetrating each unit cell in accordance with the light incident from a light source positioned beneath the unit cells as well as with a signal voltage of each cell inputted from a display data driving

section. The unit cells constituting the LCD panel are divided into a transparent section 11 and an opaque section 13, as shown in Fig. 1. Here, the opaque section 13 comprises a metal line for transmitting signals, and a black matrix for enhancing resolution by distinguishing the unit cells.

The image acquisition panel comprises a transparent substrate, and a plurality of cells aligned in horizontal and vertical directions, each cell including a photo-sensing section, a switching section, and a capacitor. As shown in Fig. 2, each cell comprises a transparent section 21 and an opaque section 23, as in case of the LCD panel in Fig. 1. The opaque section 23 of each cell in the image acquisition panel comprises a metal line for transmitting signals, and a shielding section for shielding light.

Fig. 3 is a conventional LCD panel functioning as image acquisition, which can perform acquisition of an image such as a fingerprint, while performing an LCD. Referring to Fig. 3, an LCD panel 10 is positioned beneath an image acquisition panel 20, and a light source 30 is positioned beneath the LCD panel 10 so as to irradiate light toward a bottom surface of the LCD panel 10.

The amount of light penetrating the LCD panel 10 becomes less than the amount of entire incident light due to semitransparency of the LCD panel 10. The light penetrating the image acquisition panel 20 is reflected onto an object positioned on an upper surface of the image acquisition panel 20, and incident to the image acquisition panel 20 again. Each cell constituting the image acquisition panel 20 converts the amount of incident light to electric signals by means of the photo-sensing section, temporarily stores the electric signals in the capacitor, and outputs the electric signals through the switching section in accordance with an output order of the cells.

At this stage, the LCD panel 10 is operated by a display data driving section and a gate section so as to operate each cell. The image acquisition panel 20 is operated in conjunction with the gate section and an output signal processing section.

Assuming that each cell in the LCD panel 10 in Fig. 1 is sized XL in its transversal length and YL in its longitudinal length, while assuming that each cell in the image acquisition panel 20 in Fig 2 is sized XS in its transversal length and YS in its longitudinal length, the relation between the size of the cell in the LCD panel 10 and the size of the cell in the image acquisition panel 20 becomes $XL \neq n*XS$, $YL \neq m*YS$ (here, n and m are natural numbers) under the conventional art. Since there are positions that the opaque sections 13, 23 of the respective cells are not overlapped, the entire absolute area occupied by the opaque sections 13, 23 cannot be minimized. This is illustrated in Fig. 4.

If the absolute area occupied by the opaque section 13 of each cell in the LCD panel 10 and the opaque section 23 of each cell in the image acquisition panel 20 becomes greater, the penetrating ratio of the light penetrating two panels becomes notably lower. In order to compensate for the lower penetrating ratio, the amount of light of the light source needs to be increased, thereby requiring an additional consumption of the electric power. Further, the amount of penetrating light becomes locally different, and spotting occurs in the acquired image in horizontal and vertical directions, thereby critically deteriorating the quality of output image of the LCD.

Disclosure of Invention

It is, therefore, an object of the present invention to provide an LCD panel also functioning as image acquisition, which can reduce electric power consumption and

increase life span while acquiring a high quality LCD output image by manufacturing each unit cell of the image acquisition panel to be sized one time, two times, three times, etc. of each unit cell of the LCD panel and positioning the LCD panel and image acquisition panel on a cell level so as to maximize penetration of the light.

To achieve the above object, there is provided an LCD panel also functioning as image acquisition, which is characterized by satisfying the relation of XL=n*XS, YL=m*YS (here, n and m are natural numbers) between the unit cell of the LCD panel sized XL by YL and the unit cell of the image acquisition panel sized XS by YS so that the opaque sections of the respective cells can be overlapped with each other, when the LCD panel and the image acquisition panel are layered.

Brief Description of Drawings

The above object, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagram of an LCD panel;

Fig. 2 is a diagram of an image acquisition panel;

Fig. 3 is a schematic diagram conceptually illustrating an LCD panel also functioning as image acquisition;

Fig. 4 is a diagram illustrating a conventional LCD panel also functioning as image acquisition;

Fig. 5 is a diagram illustrating an LCD panel also functioning as image acquisition according to a preferred embodiment of the present invention;

Figs. 6 and 7 are cross-sectional views of the LCD panel also functioning as image acquisition in Fig. 5; and

Fig. 8 is an example of applying this invention to a mobile product.

Preferred embodiment for Carrying out the Invention

A preferred embodiment of the present invention will be described herein below with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

Referring to Fig. 5, when manufacturing the LCD panel 10 and the image acquisition panel 20, the area occupied by the opaque section can be minimized by allowing the relation between the size of the cells of the LCD panel 10 and the size of the cells of the image acquisition panel 20 to be XL=n*XS, YS=m*YS so as to overlap the opaque sections of the two panels. Fig. 5 illustrates a case when n=2 and m=2 in the above equations. Referring to Fig. 5, opaque sections (including the metal line, the black matrix, etc.) of each cell in the LCD panel 10 is positioned on the same line as the opaque sections (including the metal line, the shielding film, etc.) of each cell in the image acquisition panel.

Fig. 6 is a cross-sectional view of the LCD panel 10 and the image acquisition panel 20 when overlapped with each other as in case of Fig. 5. Fig. 7 is a diagram illustrating a path of light in Fig. 6.

Referring to Figs. 6 and 7, the LCD panel 10 comprises a TFT panel 15 and a liquid crystal element 17. A color filter 19 is mounted to an upper section of the LCD

panel 10. A black matrix layer 13' of the color filter 19 is formed to prevent radiation of an external light source onto a switching section (not shown in the drawings) formed on the TFT panel 15, and constitutes a part of an opaque layer of the LCD panel 10. The metal line or an electrode 13" formed on the TFT panel 15 is also a part of the opaque layer of the LCD panel 10.

The opaque section 23 of the image acquisition panel 20 includes the metal line, the electrode or a shield. As shown in Figs. 6 and 7, the opaque section 13 of the LCD panel 10 is formed to overlap the opaque section 23 of the image acquisition panel 20.

By doing so, the path and density of the light become even as shown in Fig. 7. Although the light is lost in the LCD panel 10 and the image acquisition panel 20, the loss of light is minimized by positioning the transparent sections at the same line, and the opaque sections at the same line. Minimizing the loss of light means acquiring an image of high quality through a sensor by using a least amount of light. This not only means minimizing the electric power consumption of the light source but also improving the quality of image acquired by the image acquisition panel 20, thereby realizing an output of image of high quality.

The LCD panel also functioning as image acquisition according to the present invention has advantageous effects of reducing the electric power consumption, elongating the life span of the product, and achieving a high quality LCD image output as well as a high quality image acquisition through maximization of the light penetration by manufacturing the size of each unit cell of the image acquisition panel to be one time, two times, three times, etc. of each unit cell of the LCD panel so as to position the LCD panel and the image panel on a cell level.

Fig. 8 is an example of applying this invention, an LCD panel also functioning as image acquisition, to a mobile product.

What Is Claimed Is:

1. An LCD panel also functioning as image acquisition, comprising a plurality of LCD panels layered between a plurality of image acquisition panels, each panel being partitioned into transparent sections and opaque sections so as to simultaneously perform image display and image acquisition when light is irradiated thereto from a single light source, characterized in that the relation between a transversal length XL and a longitudinal length YL of the unit cell of the LCD panel, and a transversal length XS and a longitudinal length YS of the unit cell of the image acquisition panel satisfies XL=n*XS, YL=m*YS (here, n and m are natural numbers) so that the opaque sections of the respective cells can be overlapped in layers.

2. The LCD panel of claim 1, wherein n=2 and m=2.

DRAWINGS

Fig. 1

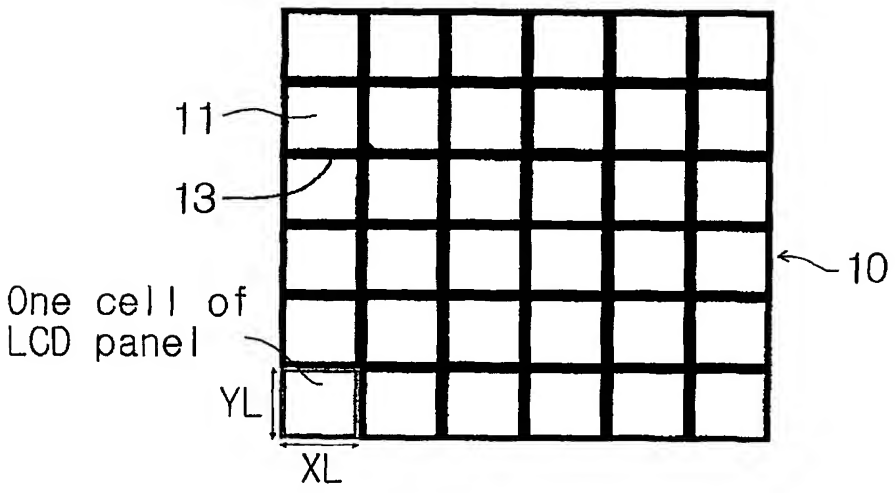


Fig. 2

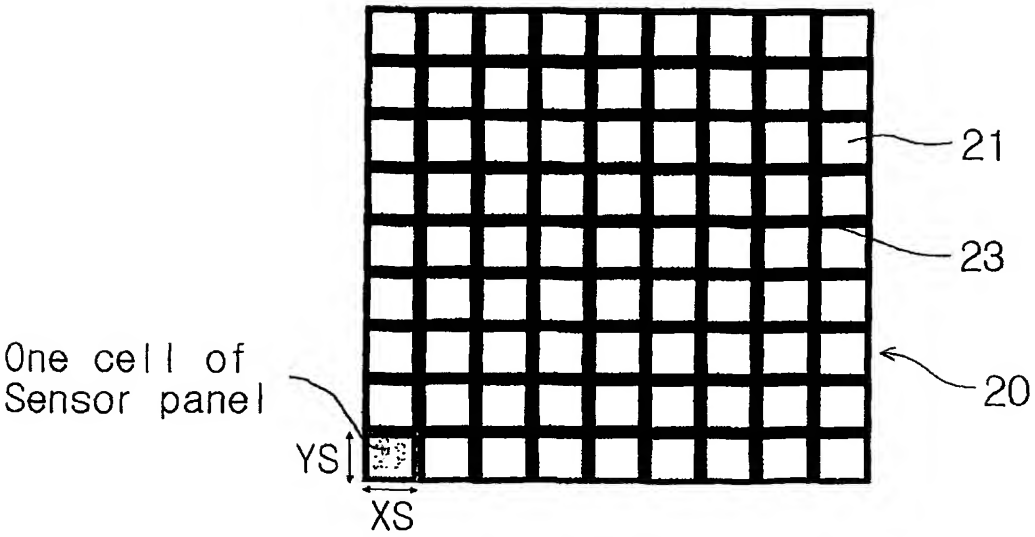


Fig. 3

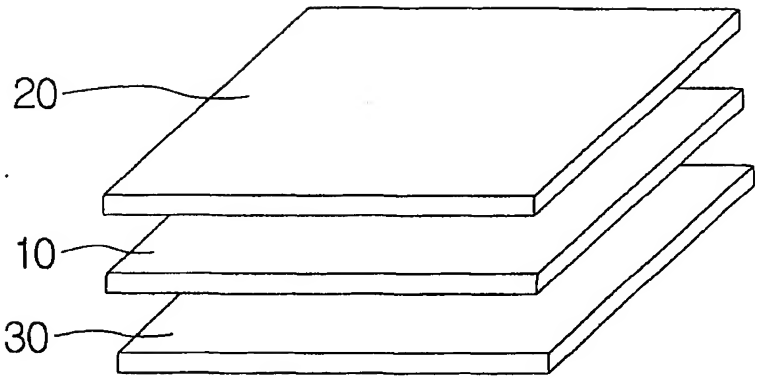


Fig. 4

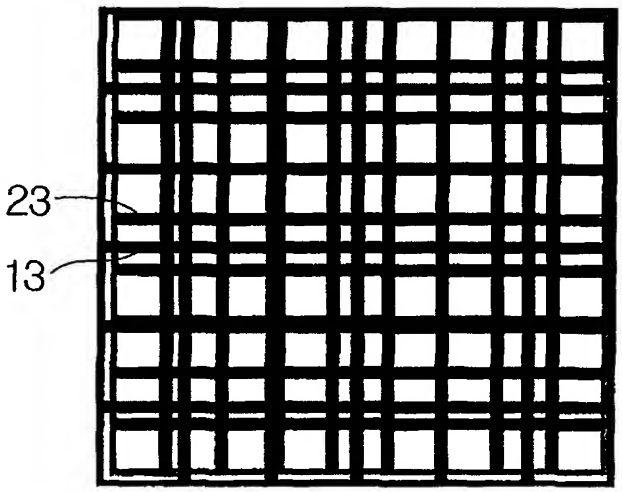


Fig. 5

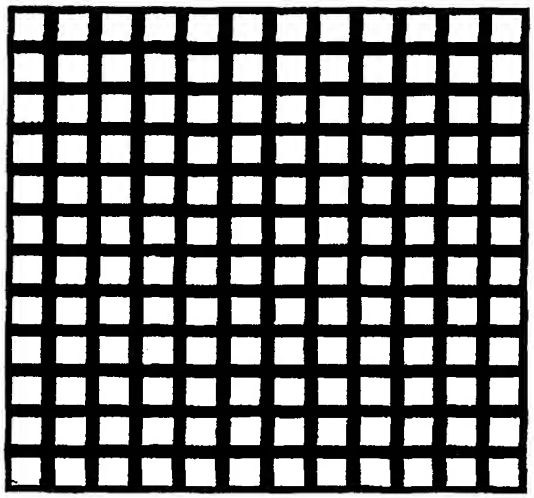


Fig. 6

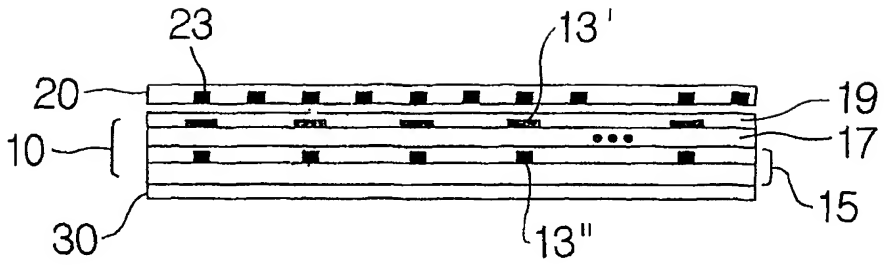


Fig. 7

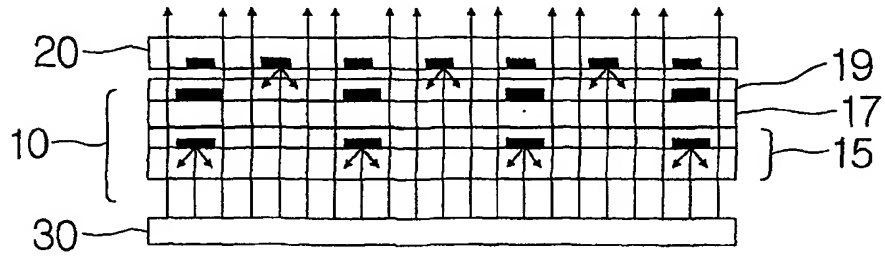
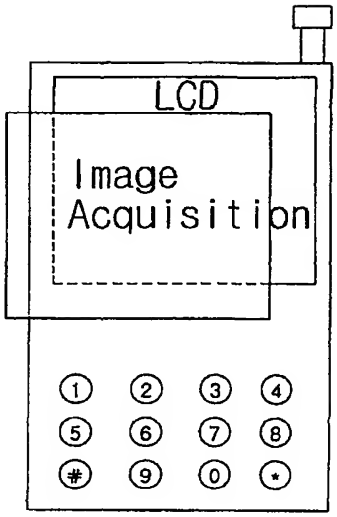


Fig. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR02/01053

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G02F 1/133

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC7 G02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NPS: "liquid", "crystal", "fingerprint"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2001-52151 A (SEIKO Instruments INC.) 23 February 2001 *the whole document*	1
Y	JP 2001-52148 A (SEIKO Instruments INC.) 23 February 2001 *the whole document*	1
A	JP 2001-42296 A (SONY Corp.) 16 February 2001 *the whole document*	1, 2
A	JP 10-142576 A (ROHM Co. LTD.) 29 May 1998 *the whole document*	1, 2

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 JULY 2002 (30.07.2002)	31 JULY 2002 (31.07.2002)

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701,
Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
KOH, Jong Wook
Telephone No. 82-42-481-5989

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR02/01053

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2001-52151 A	23-02-2001	None	
JP 2001-52148 A	23-02-2001	None	
JP 2001-42296 A	16-02-2001	None	
JP 10-142576 A	29-05-1998	None	